Navigation Doppler Lidar Sensor Demonstration for Precision Landing on Solar System Bodies

Problem Statement

- Future landing missions require accurate position and velocity data during descent phase to ensure safe soft landing at the pre-designated sites
- Current radar technology does not meet NASA landing needs
- sRLV flight demonstration of Doppler Lidar operating in closed-loop with the GN&C system will address potential interface issues and reduce the associated risk
- Potential users: Mars rover, sample return, human precursor; Asteroid sample return; Robotic and manned lunar missions

Technology Development Team

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- Possible partners: NASA-JSC, Charles Draper Laboratory

Proposed Flight Experiment

Experiment Readiness:

- TRL 5 system meeting size and mass constraints of the vehicle is presently available.

Test Vehicles:

- sRLV

Test Environment:

- Proposed Doppler Lidar system has flown on 3 helicopter platforms. Flights on sRLV being requested for altitudes of up to 2km.

Test Apparatus Description:

- Prototype Navigation Doppler Lidar unit consists of an electronic chassis and an optical head. All the lidar components are housed in the electronic chassis. The optical head consists of three transmit/receive lenses connected to the chassis via a long armored fiber optic cable. The optical head mounts rigidly to the body of the vehicle with a clear view of the ground while the electronic chassis may be installed anywhere on the vehicle. Doppler lidar offers two orders of magnitude higher measurement precision over radars while significantly reduce the required mass and power.

Technology Maturation

- A closed-loop sRLV flight test, as being proposed, will raise the Doppler Lidar TRL from 5 to 6
- Further maturation steps towards a space-flight unit are addressing Space Environment and Planetary Protection requirements, and design and build of an Engineering Developmental Unit (EDU) within a 2-year period
- sRLV flight demonstration in 2013 paves the way for consideration of the Doppler Lidar for landing missions currently being studied (e.g., 2017 RESOLVE and 2020 Mars Rover)

Objective of Proposed Experiment

- Demonstrate precision navigation and landing without the use of GPS data
- sRLV flight data will allow the design of future landing vehicles requiring precision safe landing

Technology Areas: TA09- Entry, Descent and Landing, TA04- Robotics, Tele-Robotics and Autonomous Systems, TA11- Modeling, Simulation, Information Technology and Processing